

# Methods of root canal irrigation

Wiktoria Wróblewska<sup>1</sup>, Natalia Wdowiak<sup>1</sup>, Julia Wasiluk<sup>1</sup>,  
Karolina Kot<sup>1</sup>, Joanna Zubrzycka<sup>2</sup>

<sup>1</sup> Student Science Club of Preclinical Dentistry Lab, Medical  
University of Lublin, Poland

<sup>2</sup> Preclinical Dentistry Lab, Medical University of Lublin Poland

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## Abstract

Root canal irrigation is an integral and essential part of the modern endodontic treatment, because it ensures the complete cleanliness of the canal, as well as it effectively removes the smear layer and devitalized tissues from the prepared root canals. Nowadays, a wide range of methods and tools are available for performing this stage of treatment.

The syringe irrigation as a traditional method has been the standard treatment for many years. The hand-activated irrigation is simple and efficient to use in the existing endodontic arsenal. However, it is not a method without disadvantages, the main ones being the insufficient flushing of the entire length of the canal and the possibility of gas entrapment at the apical end of the canal preventing further penetration of the flushing agent.

Nowadays, the most common method of canal flushing is the use of sound waves. There are distinctions between sonic and ultrasonic irrigation systems. With these systems, the energy is transferred from the oscillating instrument to the rinse agent, which fills the root canal inducing the acoustic streams and fluid cavitation, which leads to its activation. The ultrasonic systems have a better performance than sonic systems, but they require a greater expansion of the root canal.

Referring to novel irrigation systems in endodontics, we can expect many new developments. One of them is RindEndo System, which shows a greater depth of penetration of the irrigant compared to syringe irrigation. The second tool is the self-adjusting file (SAF), which continuously delivers fresh irrigant into the canal and then it activates the irrigating agent through the mechanical movement of the file. Another irrigation system is photodynamic therapy (PDT). The studies have shown that this method when combined with the conventional treatment, significantly reduces the amount of bacteria in the prepared canal. The promising results were also obtained from the disinfection of the canals with the ultraviolet light.

## Corresponding address:

Natalia Wdowiak  
natalia.wdowiak62@  
gmail.com

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## Introduction

Root canal irrigation is an indispensable and necessary element of modern endodontic treatment, because only with procedure we can ensure complete canal cleanliness as well as effectively remove the smear layer from the root canals. Today there is a wide range of methods and tools available to carry out this stage of treatment.

## Traditional irrigation methods of root canals

Syringe irrigation has been a mainstay of treatment for many years and studies have shown that it provides sufficient disinfection and cleaning of the root canal system. A hand-activated irrigation is simple and economical to use with the existing endodontic arsenal. Hand-activated irrigation with a GP point has demonstrated to be superior to a static irrigation. The GP point should be moved in 3-millimeter front-to-back movements with the frequency of 33 Hz, which translates into one hundred beats per thirty seconds.

However, syringe irrigation has some drawbacks. The main ones is the insufficient flushing of the entire length of the canal causing the irrigation fluid to fail to reach more than 1 mm beyond the tip of the syringe creating a stagnant plane of the non-irrigated canal.

This method can also cause gas entrapment at the end of the canal preventing the flushing agent from penetrating to the apex of the canal.

Ex vivo studies have also shown the risk of root apex extrusion when using the dynamic irrigation method [1].

## Contemporary methods of irrigation of root canals

Nowadays, the most common method of root canal irrigation is the use of ultrasound device, which assists in the activation of the flushing agent.

There are sonic and ultrasonic irrigation systems, such as EndoActivator and ProUltraPiezoFlow.

Sonic and ultrasonic irrigation systems Sonic and ultrasonic instruments transmit energy from the oscillating instrument to the irrigating agent in the root canal by means of sonic or ultrasonic waves and induce acoustic streams and cavitation of the flushing agent [2].

The phenomenon of cavitation and acoustic flux allow activation of the rinse agent. The ultrasonic instrument generates a heat, which leads to an increase in the temperature in the irrigant fluid, so that the heated NaOCI increases its lytic and antimicrobial activity. The ultrasonic systems have better performance than sonic systems due to the greater amount of dentin residue removed and the higher speed of the acoustic jet. The ultrasonic units can be piezoelectric or magnetostrictive. The piezoelectric system transfers more energy to the files, generates less heat, and may include small tips with a special shape.

The ultrasonic irrigation is referred to „passive” because it is its objective to prevent the file from the penetrated canal walls, which can lead to an uncontrolled and irregular dentine cutting. Therefore, lavage with ultrasound should be performed after the canal has been prepared and widened.

There are two types of irrigation methods in PUI. The first is a continuous flush of irrigating fluid from the ultrasonic handpiece, followed by the intermittent flushing with syringe between activations, which is activated by ultrasound with 2% NaOCI for 3 minutes delivering 2 ml hypochlorite every 30 seconds. The key point to note about the ultrasound activation is that acoustic jet cavitation can only occur in liquids, so if there is an apical gas bubble and the tip goes into this, you will not get an effective irrigation in this area.

The EndoActivator is a sound canal irrigation system that comes with a portable handle and disposable, non-cutting polymer tips to reduce the risk of iatrogenic damage. The smooth tip allows the operator to perform vertical up and down movements, which has been found to remove debris from the canal much better as compared to the conventional or ultrasonic syringe [3].

One disadvantage of EndoActivator tips is that they are permeable to X-rays and the tip can break.

Prolltra®PiezoFlow™M is an ultrasonic irrigation device that consists of a disposable needle attached to an ultrasonic headpiece. However, there is a lack of adequate research on the application of this device to determine whether its effects are beneficial for the proper root canal irrigation.

## Innovative methods

When it comes to the innovative irrigation systems in endodontics, we can expect many new developments. The researchers working on systematic reviews have not found sufficient evidence of an association between the irrigation systems and successful endodontic treatment. However, clinicians mostly agree that root canal irrigation is an essential procedure in a proper endodontic treatment [4].

One irrigation system is RindEndo system, which consists of a device connected to an air turbine. It delivers irrigant to the cannula in cycles that alternate 100 times per minute.

When compared to syringe irrigation, it shows a greater depth of penetration of the flushing agent.

The second tool is the self-adjusting file (SAF), whose greatest advantage is that fresh irrigating fluid is fed into the canal continuously and is then activated by the mechanical movement of the file. The tool is compared to an arterial stent with an abrasive surface that conforms in shape to the root canal. Many endodontists are skeptical about this type of a device, as one of the necessary steps is to work the root canal apex down to the size 20 to work with the SAF system.

Another recently popular solution in dentistry is ozone. However, for the root canal treatment, studies

have shown that sodium hypochlorite is more effective than ozone alone. Ozone has applications in caries treatment and mineralization. Although even here clinicians are not unanimous about ozone's effective action.

Another innovative irrigation system worth mentioning is photodynamic therapy (PDT). It works by creating free radicals and singlet oxygen which has mainly an antimicrobial effect. Studies have shown that this method, when combined with a conventional treatment, results in a significant reduction in the amount of bacteria in the canal.

The disinfection of the ducts with the ultraviolet has also demonstrated promising results. The study consisted in the placement of a special UV lamp in the root canal, immediately after the disinfection with sodium hypochlorite. However, this method is contraindicated if the canal has perforations, or an open root apex [5].

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